

## Place Your Bets! Information Aggregation and Prediction Markets in MBA Courses

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### Abstract

At the School of Management, University of Haifa (<http://gsb.haifa.ac.il>), novel Internet-based tools are employed in order to enrich the instruction of theoretical aspects with hands-on experience, and expose the students to these unique tools. One example is the incorporation of Information Markets in several MBA courses. Information Markets use the financial markets mechanism as an information aggregation and processing engine. In this case the underlying asset is a statement to be evaluated or an event to be forecasted. The price that results from trading the contracts reflects the market opinion as to the event's probability to occur or the statement to be correct.

In class, Information Markets theory teaching is complemented with a hands-on experience of trading in preconceived markets. Two types of markets are implemented in order to expose the students to the versatility of the tool: prediction market and information aggregation markets. We found that the hands-on activity is essential to enhance the understanding of this complex topic, and added interest and excitement to the lessons. Furthermore, we found that by surfacing opinions and attitudes of the students, this activity can assist in improving instruction processes and in-class dialogue. The development of an effective teaching environment required a large investment in time, but the monetary costs were relatively low.

**Keywords:** online simulations, prediction markets, wisdom of crowds, MBA course.

Critics of MBA programs claim that business education is too theoretical and detached from the real needs of corporate managers (Thompson, 2008). One way to reduce the gap between theory and practice is to incorporate computerized, networked, tools such as business games, management simulations and decision support tools as part of the curriculum. This paper presents the application of a novel internet-based decision support tool, known as Information Markets, in MBA courses at the School of Management, University of Haifa (<http://gsb.haifa.ac.il>).

Business success often depends on the ability to make prudent decisions and judgments, and correctly anticipate future events. While early research on human judgment processes was based on the premise of rational choice, i.e. maximizing expected utility (Morgenstern & Von Neumann, 1947) and Bayesian reasoning (Savage, 1954), Kahneman and Tversky developed Prospect Theory (Kahneman & Tversky, 1979) which challenged these concepts. They showed that heuristics are used by individuals making judgments under uncertain conditions, leading to biases in the judgment outcome, and producing decisions that deviate from rationality and are not optimal.

Intuitively, group deliberation by several people with diverse perspectives and information should better serve the decision process assuming that intra-group interaction will reduce individual biases, creating synergies and learning which will improve the group performance as a whole. In many cases this was indeed the situation (Brown, 2000) nevertheless group deliberation has its down sides. Group members may impose informational influences and social pressure on each other (Gigone & Hastie, 1993). Irving Janis, in his Groupthink model (Janis, 1972), suggested that in situations where groups are highly cohesive, operate under directed leadership, experience conditions of high stress, and perform limited search or appraisal of information, the group is likely to follow the judgment favored by the influential members. Additional methods, such as voting and polls, attempt to improve decisions by collecting information from very large groups. With the diffusion of the Internet into our daily lives, new ways of sharing and aggregating information and collecting opinions have been introduced. In his book *The Wisdom of Crowds*, (Surowiecki, 2005) outlines the conditions required in order to effectively elicit the collective knowledge from a large group:

1. Diversity –participants have different perspectives about the issue or question at hand.
2. Independence –participants possess independent information, and are not inter-dependent by way of hierarchy or any other way.
3. Decentralization – participants do not communicate and influence each other
4. Aggregation mechanism – there is a mechanism that combines all pieces of information into a one coherent entity

Recently we are witnessing increased academic and business interest in the application of markets for information aggregation and decision support. Markets comply with the requirements of an efficient decision support tool while overcoming some of the shortcomings of the other methods.

Information Markets use the financial markets mechanism as an information aggregation and processing engine. In this case the underlying asset is a statement to be evaluated or an event to be forecasted. The price of the contract reflects the market opinion as to the event's probability to occur or the statement's chances to be correct. On the due date of the event, the market closes, the price of the stock that represents the actual outcome is fixed to the predefined amount, and all other stocks are nullified. The payoffs due to the traders are computed according to their holdings and the actual outcome of the event. These markets are implemented as an Internet-based system in the public domain (for example [www.intrade.com](http://www.intrade.com) and many others) or in an organizational environment (Cowgill, Wolfers, & Zitzewitz, 2008; Hopman, 2007). Examples of typical questions resolved by markets are: Who will win the 2008 presidential elections? What will be the sales volume of product X in the first quarter of 2009? Will project Y be completed by March 2009?

Three different types of Information Markets are used to support decision processes:

- **Information Aggregation Markets (IAM)** – involve the collection of past information in order to solve a problem. In this case the uncertainty of the outcome results from a lack of knowledge. This lack of knowledge can originate from asymmetric information distribution among participants or from incomplete information, where people maintain only part of the required information (Page, 2007).
- **Prediction Markets (PM)** – evaluate future uncertain events (Wolfers & Zitzewitz, 2004). In this case the outcome of the event can be affected by other unknown actions or events which have not yet occurred. This is the most common use of IM, and often lends the name to the whole family of tools.
- **Opinion Markets (OM)** – process the subjective opinion of a group on a topic that does not have a deterministic outcome (Dahan, Lo, Poggio, Chan, & Kim, 2006).

Information Markets of all three types incorporate a monetary incentive based on the performance of the trader. Economic gains for each player are proportional to the quality of the player's predictions, and it is also possible to lose money by "betting on the wrong horse". This structure encourages people to participate only if they have at least minimal knowledge on the topic, and it provides an incentive for disclosing true private knowledge. Due to anti-gambling regulations and budget limitations most markets use play money as incentive. Studies show that the use of play money does not diminish market accuracy (Servan-Schreiber, Wolfers, Pennock, & Galebach, 2004).

In the following we describe how Information Markets are woven into courses and help in teaching various aspects of decision making including the behavioral dimension.

### **Implementing Prediction Markets in the Curriculum**

At the School of Management, University of Haifa, the topic of Information Markets has been incorporated into the curriculum as it provides:

- A unique example for knowledge sharing between people
- An example for an information aggregation and prediction mechanism
- A good platform for understanding markets and incentives
- A good platform for understanding behavioral aspects in knowledge sharing and decision making under uncertainty
- A novel extension to the arsenal of decision support tools
- A tool which the students can further implement at their work places

In class, Information Markets and decision making theory teaching is complemented with a hands-on experience of trading in preconceived markets. This is done on a commercially available platform ([www.inklingmarket.com](http://www.inklingmarket.com)) by setting markets designed to address the lesson objectives.

Currently two main market types are employed:

#### **The Hidden Profile Market**

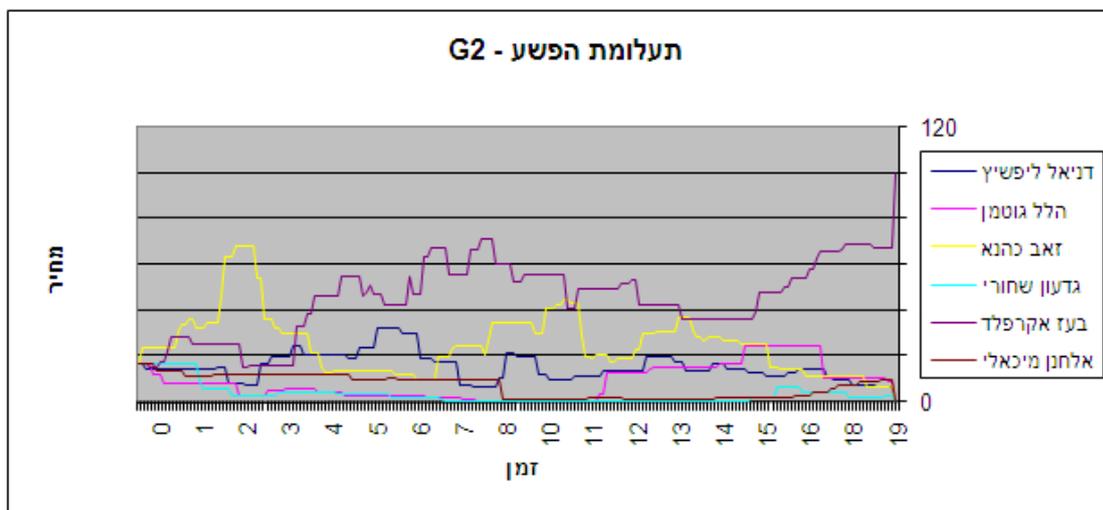
Hidden Profile is an IAM where segments of information are distributed among several participants but when all information is collected, a complete and certain picture is obtained (Stasser & Titus, 1985).

The students are presented with a crime scenario and details about 6 suspects, including the villain. A market with six stocks, each representing a suspect, is set-up. Each student receives private information, which consists of an alibi for some of the suspects. The exercise is designed in a manner that if all private information is combined, the guilty person can easily be identified. The students are instructed to buy the stocks of the suspects they believe might be guilty and sell stock of suspects they believe are innocent. The market runs for 20 minutes, and during this time the students are not allowed to talk. When the market closes the stock representing the villain is expected to achieve the highest price.

During the development of this scenario we found that some the students had difficulty to understand the trading procedures. Consequently we have developed additional training markets similar in structure to the Hidden Profile scenario. The tasks in the training markets required the aggregation of information from public sources on the Internet. We have also developed a detailed training kit. Currently the students practice with the training markets before they proceed with the crime scenario exercise.

## Results

The price chart in Figure 1 reflects the change in market opinion regarding the identity of the villain during the 20 minutes of trade.



**Figure 1: Hidden Profile – market trading chart**

The activity was performed in four markets. Only one market correctly identified the criminal. In the discussion that followed trading, selling and buying patterns were analyzed. The cascading effect, a known effect in market bubbles (Shiller, 2002), the negativity bias (i.e. the tendency to use negative information more than positive information), and the effect of stereotype on information aggregation (Johnston, 1996; Stewart, 1998) were demonstrated.

After the activity the students were asked to fill in a questionnaire regarding their impressions on the effectiveness of the tool and the difficulty in performing the activity. Some students thought the tool was not effective, however, most found the activity interesting, relevant, and reasonably easy for MBA students.

## Prediction Market

This scenario was introduced as a complementary, voluntary, activity in the business game course that takes an entire term in the MBA program. In this business game students are charged with managing firms competing in a virtual "world". The students work in teams, each responsible for operating one firm for several game "years" and the team that achieves the highest shareholder value by the end of the last year wins the game. There are two main periods in the game. In the first few years the students operate in a single-firm mode, and experience the various aspects of managing a firm. On the fifth year the option of mergers & acquisitions is activated, and the students experience additional skills such as negotiation and management of multi-firm corporations.

A Prediction Market was set up to predict the winning team. The markets opened on the last year of the single-firm stage and closed a few hours before the final game results were published. The students, who were players and PM traders, traded under conditions where they had a certain perceived sense of influence on the outcome. The business game is characterized by an intense atmosphere of activity and speculation.

In order to maintain interest, and increase activity and participation in the marketplace, every week supplementary events addressing intermediate results of the game as well as events that

relate to general current events were defined. The incentive scheme consisted of two prizes: one for the student who achieved the most assets when the markets closed, the other a participation prize based on a draw.

## Results

The price chart in figure 2 reflects the market prediction of the winning firm. Each vertical line indicates the end of a virtual year.



**Figure 2: Business game – market trading chart**

The markets were run in three MBA classes. 38 out of 114 students participated in trading, representing 18 out of the 20 firms. All the students were previously exposed to the concept of Information Markets, but only one of the classes had participated in the Hidden Profile market which is described above.

The analysis of the market results confirmed our observation that once the side-effects of the M&A settle down (after a year or two), the students think that the identity of the winning team is determined.

The different configuration of the market, the fact that it was a voluntary activity, and was open for a longer time required additional measures and incentives for maintaining interest.

## Conclusions

The hands-on activity helped to enhance the understanding of a complex topic, and added interest and excitement to the lessons. It also surfaced significant biases in group decision making processes which call for deeper research attention.

We found that this kind of activity can also assist in improving teaching processes by surfacing opinions and attitudes of the students towards the instruction process and content. Similar use of Information Markets is found in corporate settings (Cowgill et al., 2008).

The availability of the Internet platform and the abundance of new off-the-shelf applications open new opportunities for changing and improving the instruction process. It is possible today to incorporate computerized simulations in the curriculum at a relatively low monetary cost, however, there is a need for a large investment in time in order to develop an effective teaching environment.

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